Exhibit

Professional Program Session Record **10**

System Design Flexibility Offered by Flash EPROM/E²PROM

Electronic Show and Convention
November 15-17/Anaheim, California

Sponsored by Los Angeles Council and San Francisco Bay Area Council, IEEE
Southern and Northern California Chapters, ERA

FLASH TECHNOLOGY: BRIDGING THE GAP BETWEEN EPROMS AND EEPROMS

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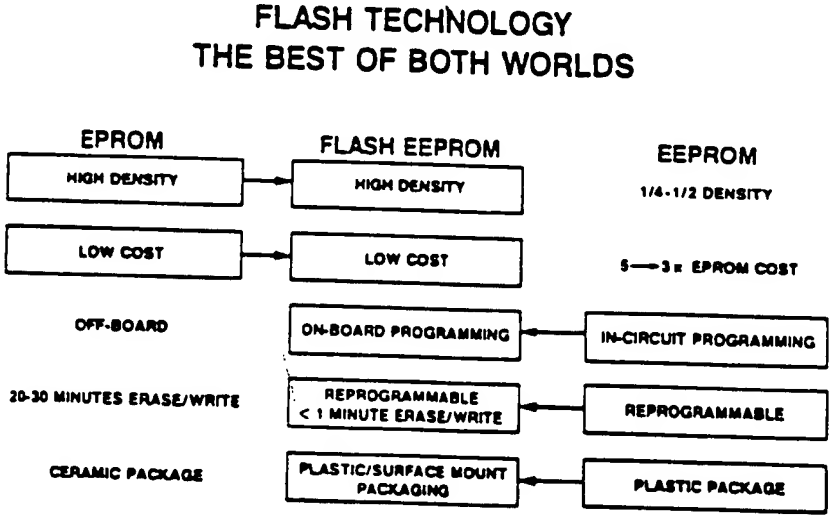
SUMMARY

FLASH technology, an innovative development in nonvolatile memory design, bridges the gap between high-density, cost-effective UVEPROM and the packaging options, reprogramming speed, and in-circuit programming flexibility of full-featured EEPROMs. The 48F512, a 64K x 8 CMOS FLASH memory is reported. FLASH memories open the door for new application approaches where the previous inflexibility of UVEPROMs and cost of full-featured EEPROMs were prohibitive.

Introduction

In the past, system designers using reprogrammable nonvolatile memory for program store applications had relatively few options. Some of the features which needed to be considered included programming flexibility, density requirements, packaging options, and implementation costs. Two possible design alternatives were available: UVEPROMs or EEPROMs. Each approach had it's benefits and drawbacks.

Historically, program store designs used UVEPROMs to satisfy the high density and low cost per bit needed in most applications. However, UVEPROMs severely limited the users ability to modify the memory once installed. Exposing devices to UV light meant removing the memory from the system for processing. Windowed packages, for all practical purposes, restricted package options to cerdip. Plastic and surface mount technology UVEPROMs were available, but were limited to applications which could use one time programmable parts. Software updates to UVEPROM based systems were cumbersome, time-consuming and expensive.



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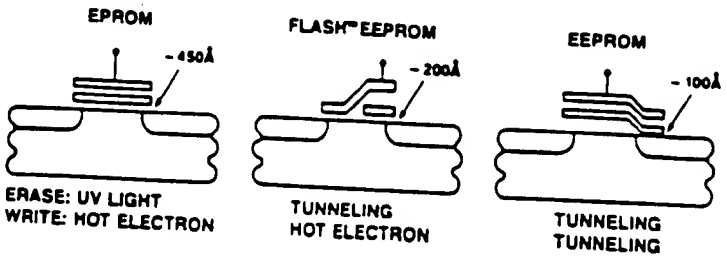
Designs which incorporated full-featured EEPROMs into their applications increased system flexibility, provided fast in-circuit reprogrammability, and added plastic and surface mount package options. These features offered designers significantly improved system programmability and package options, but came at the expense of increased die size and costs. Larger die sizes and increased design/process complexity limited density of EEPROMs to one-half to one-quarter the size of UVEPROMs. On a per bit basis EEPROMs were up to 10 times as expensive as the equivalent density UVEPROMs. Clearly there existed a need to fill the density, cost and functionality gap between these two technologies, FLASH memories are the solution.

Bridging The Gap

SEEQ's 48F512 is the first device to bring together the high density (512K), low power, and cost effectiveness of UVEPROMs, with the in-circuit reprogrammability and package technology options of EEPROMs. The ability of the 48F512 to be programmed in-circuit, is enhanced by offering two different erase/reprogram options. Any one of the devices 128, 512 byte sectors can be individually erased and reprogrammed, or the chip can be bulk erased before reprogramming. Control of the chips sector or chip erase features along with all other device write/read functions are handled through the VPP pin and three control pins, no additional software overhead is required. On chip latches and timers permit simplified microprocessor interface, freeing the microprocessor to perform other tasks once write/erase/read cycles have been initiated. With the 48F512, package options are no longer a secondary concern for nonvolatile memory users. Previously, high density and cost sensitive nonvolatile memory applications, forced users to compromise board designs. The through hole assembly technique needed for UVEPROMs, complicated board layout and limited board density. Designs utilizing surface mount technology had to create

NON-VOLATILE MEMORY STRUCTURES



in the initial costs between UVEPROM and FLASH memory. Applications such as cellular radio, which use nonvolatile memory to store phone numbers and frequencies of cell repeaters, will use FLASH memories for initial programming and easy updating if user location changes. Point-of-sale terminals will be able to upgrade product offerings and prices quickly, from remote locations, without hardware modifications. In these types of applications, FLASH memory will improve system flexibility while reducing overall device ownership costs.

The availability of high-density, low-cost, in-circuit reprogrammable memory have created the opportunity for a wide variety of new applications not previously possible using UVEPROM or EEPROM. The 48F512 and larger density CMOS FLASH memories open the door for replacement of power-hungry floppy disk drives, with low-power, high-density silicon disk in portable computers. These are just a few examples of how FLASH memories are changing the way memory designers think about use of nonvolatile memory.

In the future, the low-cost, high-density and in-circuit reprogrammability features of FLASH memories will be used to replace - UVEPROM, magnetic tape and bubble memory. Bridging the gap between UVEPROM and EEPROM, FLASH technology will become the program memory of choice by designers for next generation memory applications.